

Nuclear magnetic resonance offers new insights into Pu 239

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Fingerprint of element found by LANL/Japanese team

The faint signal of plutonium 239's unique nuclear magnetic resonance signature has been detected by scientists at LANL and the Japan Atomic Energy Agency (JAEA).

This signal promises to become a Rosetta stone for deciphering the complex atomic-scale electronic properties of this perplexing element. Their paper on the subject, "Observation of ²³⁹Pu Nuclear Magnetic Resonance," was published in the May 18 issue of [Science](#).

Discovery ends 50-year search for nuclear magnetic resonance signal

For more than 50 years, chemists and physicists have been searching for the plutonium 239 magnetic resonance signal. Only now, in an international collaboration between LANL and the Japan Atomic Energy Agency, a team of chemists and physicists at LANL together has determined just the right conditions for observing the signal.

The team led by visiting professor Hiroshi Yasuoka of JAEA and Georgios Koutroulakis of LANL observed the plutonium 239 resonance from a high purity solid sample of plutonium dioxide, PuO_2 , at a temperature of 4 Kelvin as a function of magnetic field.

Observation of matter at atomic scales

Since its discovery in 1946, nuclear magnetic resonance (NMR) spectroscopy has evolved into one of the most widely used techniques for the characterization of materials at the atomic and molecular levels and has formed the basis for magnetic resonance imaging (MRI).

NMR has revolutionized the practice of chemistry, physics, and medicine by providing a non-invasive method for the observation of matter at atomic scales.

“Just as knowing the NMR properties of other nuclei has advanced so significantly our ability to understand complex materials and phenomena as well as to image matter on a microscopic scale,” said Koutroulakis. “This discovery of the plutonium 239 magnetic resonance promises to revolutionize our understanding of plutonium solid state physics, chemistry, biology and materials science.”

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